



**St John**  
Here for Life

# Out-of-Hospital Cardiac Arrest Registry

**Annual Report 2016/17**







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## Clinical Audit and Research

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## Life on the line for Lorraine Adams

**Five years ago, Lorraine Adams and her partner moved from south Auckland to live in Taumarunui, the town famous, among other things, for being on the main trunk line. From Lorraine's perspective there's a lot to be said for living in Taumarunui, living being the operative word.**

Shortly before 8pm on August 6, 2016, the now 56 year-old Lorraine collapsed while catering at a function at the Taumarunui Women's Club in Miriama St. Her heart literally stopped.

It just so happened that off-duty St John Ambulance Officer Elizabeth Gellatly, whose mother the function was for, was at the club so she immediately started CPR while other bystanders called 111 for an ambulance.

"The St John ambulance was called at 7.54pm and arrived two minutes later. Elizabeth and Ambulance Officer Hannah Cruickshank delivered the first defibrillator shock at 7.59pm and the patient achieved ROSC [return of spontaneous circulation] shortly afterwards," says Ruapehu Central Region Territory Manager Mark Fredericks.

"Lorraine was transported to Taumarunui Hospital for initial treatment at 8.17pm, pending arrival of a rescue helicopter. That arrived at 8.49pm and, after being treated by paramedics and hospital staff, Lorraine was flown to Waikato Hospital.

"Had it not been for the immediate onsite attention Lorraine received from Elizabeth, life in Taumarunui for Lorraine could have ended on August 6, just 17 days before her 56th birthday."

Lorraine says she doesn't remember much about that night or the days either side of it.

"It's amazing to know I'm still standing. I'd had a slight heart attack a year earlier and had a stent put in. After this episode, I have three.

"My story has gone viral and so many more people in our town and the surrounding rural environment know the value of having someone with CPR knowledge around when a cardiac arrest strikes.

"The local supermarket has since installed an AED and the two women's groups I regularly attend know all about the importance of first aid including CPR."



Elizabeth Gellatly (left) and Hannah Cruickshank (right).

Ambulance Officer Hannah Cruickshank says the stars really aligned for Lorraine that night.

"With Liz on scene, which was only two minutes' drive from the ambulance station, and having a helicopter already on the way due to an earlier call out, someone was really looking out for her!"

For Kawerau Ambulance Officer Elizabeth Gellatly, the experience she had at her mother's 70th birthday party was the first time she'd responded to an emergency situation as a bystander.

"It was very strange for me. Having to administer CPR without any of my usual equipment at hand and doing so in front of at least 50 people I knew, made the situation all that more intense.

"I wasn't aware of Lorraine's existing medical issues but I'm very glad that I made the decision in 2011 to change career from working in finance in Melbourne to retrain to be an EMT with St John.

"I'm pretty sure Lorraine is too!"

Elizabeth now lives in Rotorua and is a fulltime ambulance officer studying to be a paramedic.

And what of the 70th birthday party?

"There was obviously a good outcome for Lorraine on scene so, after a dull mood for a while, the party livened up, so to speak." ■



## From the Chief Executive Officer

**It is really pleasing to see the quality of work our Clinical Audit and Research team produce each year. This, the fourth Out-of-Hospital Cardiac Arrest Registry Annual Report, is a great example of it.**

Over the past year in particular, ambulance services in Australasia have had an increasing focus on sharing best practice and benchmarking with each other to see what more we can all do to improve out-of-hospital cardiac arrest survival. An example of this is our service (along with others internationally) joining the Global Resuscitation Alliance and adopting the 10 steps to improve survival following cardiac arrest. The first of the 10 steps is to establish a cardiac arrest registry, so we are off to a good start.

It is an exciting time in the area of cardiac care in our service with many other developments planned over the coming years from the new STEMI pathway

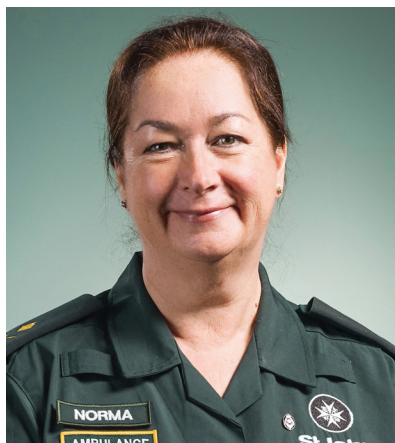
and the introduction of Restart a Heart Day in New Zealand, to an increasing focus on telephone CPR, Community AED availability and the use of technology to alert volunteer bystanders who can respond to provide CPR and defibrillation.

We also know that the recent announcement of Government funding to double crew all our emergency ambulances in New Zealand will have a positive impact on survival following cardiac arrest.

Meantime, St John has a lot to be proud of and this report highlights some excellent results for our patients. ■

**Peter Bradley**  
*Chief Executive Officer*





## From the Director of Clinical Operations

**The St John New Zealand Out-of-Hospital Cardiac Arrest Registry annual report is one that everyone eagerly anticipates as it reflects the hard work and efforts across all our functions – clinical, corporate and community – and the contribution of key stakeholders over the past year.**

Each year St John aims to improve on the previous year's performance and introduce new initiatives to increase the survival rate of New Zealanders. We can see from recent statistics that our public messaging and awareness campaigns are having an impact with public access defibrillator use rising from five per cent to nine per cent over the past four years.

The support of sponsors such as ASB has been fantastic. ASB has installed defibrillators in all their branches and their support of our ASB St John in Schools programme helps to significantly improve public education and awareness.

Early recognition of a cardiac arrest and bystander intervention is key to patient recovery and everyone involved in assisting our patients – from bystanders, Clinical Control Centre staff, front line crews, volunteers, Fire and Emergency New Zealand co-responders, air ambulance teams to hospital staff – can be proud of their collective contributions to these impressive results.

Our ambulance response times to cardiac arrest callouts have dramatically improved with our median response times in urban areas dropping from eight

minutes in 2013/14 to five minutes in 2016/17.

Even more impressive are the response results for our more challenging remote and rural areas which have fallen from a median of 11 minutes in 2013 to eight minutes in 2016/17. Co-response by Fire and Emergency New Zealand is definitely a contributing factor to the increased performance and we thank everyone involved who has assisted us reach our patients as quickly as we can.

We know there is always more we can do so, over the coming year, we will implement some major service developments. These include continuing the roll out of the four-year Double Crewing Project which will see the end of single crewing and transportations. Double-crewed ambulances greatly improve the chances of good clinical outcomes for our patients.

Building on the importance of facilitating early access to defibrillators for bystanders, we are looking to introduce a mobile phone app next year designed to give healthcare professionals and other trained individuals urgent alerts to a cardiac arrest that is taking place nearby so that they can respond quickly. Initiatives like these will further improve our overall performance and help to save more lives.

We look forward to another great year building on the good work from previous years. ■

A handwritten signature in black ink that reads 'Norma'.

**Norma Lane**  
*Director of Clinical Operations*

# The St John emergency ambulance service

**St John is New Zealand's largest emergency ambulance service (EAS) covering around four million people or approximately 90% of the population.**

The service operates across 97% of New Zealand's geographical area while Wellington Free Ambulance covers the Wellington and Wairarapa regions.

The organisation calls on more than 1,600 paid and over 3,000 volunteer ambulance officers to provide care to the more than 400,000 patients treated each year. Ambulance officers in New Zealand may be vocationally trained (National Diploma, NZQA Level 4 – 6), hold a three-year Bachelor of Health Science degree in paramedicine or hold post-graduate qualifications in advanced resuscitation. St John ambulance officers, both paid and volunteer, are supported through ongoing clinical education.

In an emergency New Zealanders dial 111 and are directed by telecommunications company Spark to one of three emergency agencies. Every day around 1,300 of these calls are for an ambulance. St John owns and runs the 111 Clinical Control Centres in Auckland and Christchurch and helps run a third in Wellington, in a joint venture with Wellington Free Ambulance.

## Responding to a cardiac arrest

When an emergency ambulance call comes in, St John call handlers use the medical priority dispatch system (MPDS) to triage calls and determine the appropriate level of response to a call. A colour coded response system is used, based on international best practice.

An immediately life threatening call, such as a cardiac arrest, is allocated a 'purple' response, takes precedence over all other calls and the closest

responder is immediately dispatched. This may be an emergency ambulance or any other co-responder including the St John Patient Transfer Service, Fire and Emergency New Zealand, local first response groups or Primary Response in Medical Emergencies (PRIME) doctors and nurses. An intensive care paramedic qualified in advanced life support is also sent to all suspected cardiac arrests, when available.

For a suspected cardiac arrest, the St John call handler instructs the caller to use an AED if available and guides them through the process of performing CPR.

Once ambulance officers reach the patient, they may continue the resuscitation attempt. Depending on the qualification of the responding personnel, they may also provide advanced life support such as advanced airway management, drug therapy, physiologic monitoring and post-cardiac arrest care.

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## A cardiac arrest is allocated a 'purple' response and the closest responder is immediately dispatched.

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The cardiac arrest protocols used by ambulance officers have been developed by the National Ambulance Sector Clinical Working Group<sup>1</sup>. In situations where resuscitation is not feasible, or clearly not in the best interest of the patient, St John ambulance officers may elect not to start a resuscitation attempt. When a resuscitation attempt is underway, it may later be stopped by ambulance officers following the written protocols within the St John Clinical Procedures and Guidelines<sup>1</sup>. ■





## About this report

### **Cardiac arrest remains a considerable public health issue, with ischaemic heart disease being the second most prevalent cause of death in New Zealand<sup>2</sup>.**

Internationally survival rates following Out-of-Hospital Cardiac Arrest (OHCA) are highly variable and can range from less than 6% to greater than 50%<sup>3</sup>. Benchmarking survival from OHCA is a key measure of the clinical quality of an EAS and fundamental to making improvements in OHCA survival<sup>4</sup>. Knowledge of New Zealand OHCA outcomes is a key driver to help identify and address areas for improvement in clinical care.

The data presented in this report is for all OHCA attended by the St John EAS in the period from 1 July 2016 to 30 June 2017. The data for this report was extracted from the registry on 11 October 2017.

The data is collated in the registry using a reporting template based on international definitions outlined in the Utstein style of reporting and the variables developed by the Australian Resuscitation Outcomes Consortium (Aus-ROC)<sup>5-6</sup>.

Where possible comparisons are drawn with Wellington Free Ambulance, Ambulance Victoria, London Ambulance Service, St John Ambulance Western Australia and King County Emergency Medical Services (EMS) in Washington USA<sup>7-11</sup>. These services were selected as the definitions and collection variables that are used in the St John OHCA Registry are similar to those used by these services.

The data presented in this report primarily relates to events that were either 'attended' or where there was a 'resuscitation attempted' by St John EAS personnel. 'Attended' refers to all OHCA where St John EAS personnel arrived at the scene regardless of whether or not a resuscitation attempt was made. 'Resuscitation attempted' refers only to those events where an attempt at resuscitation was made by EAS personnel.

Descriptive statistics were performed with statistical software SPSS (IBM v24) and tests were chosen depending on whether the data fitted a normal distribution with equivalent variances in the standard deviation. Results were determined to be significant if  $p < 0.05$ .



All population figures in this report are derived from Statistics New Zealand population data using the online population tools or population tables<sup>12-15</sup>. The population figures provided are for the end of June 2016, with the population of the St John response area being 4,187,900.

Unless otherwise stated, all analyses excludes cardiac arrests witnessed by St John EAS personnel. If it is unrecorded whether the patient is a child or an adult, then these events are assumed to be adults and are included in the adult category.

Unless otherwise stated, survival refers to survival to 30-days post cardiac arrest. ■

## Executive summary



**5 people a day**

(approx) were treated for an out-of-hospital cardiac arrest in New Zealand (nearly 2,000 per year)

31% female, 69% male



**72%**

of patients received bystander CPR



The median time in which a St John ambulance reached a patient was **5 minutes** in urban communities and **8 minutes** in rural and remote communities



**9%**

of patients that had a cardiac arrest in public were defibrillated with a public access defibrillator



**82%**

of events were co-responded to and attended by Fire and Emergency New Zealand



**27%**

of patients survived the event (had a pulse on arrival at hospital)



**12%** of patients survived










# Benchmarking executive summary

The current 2016/17 report is the fourth consecutive OHCA Registry Annual Report. This report represents a turning point for St John as it employs the first full year of data collected electronically at the point of care by ambulance personnel. The progression to an electronic platform will future-proof successive measuring and reporting which is key to improving outcomes from OHCA.

Key figures from the current and the previous reports are shown in Table 1. ■

**Table 1: Key figures for all-cause events<sup>A</sup> (resuscitation attempted).**

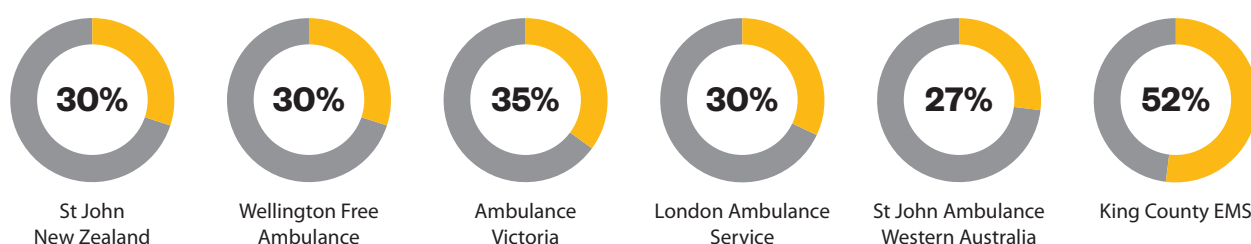
Year	Total number events	 % Bystander CPR	 % Public AED use	 Urban median response time	 Rural & remote median response time	 % Attended by Fire & Emergency New Zealand	 % ROSC on handover	 % Survival
2013/14 (9mo)	1101	75%	5%	8	11	45%	27%	13%
2014/15	1690	74%	6%	8	10	82%	28%	12%
2015/16	1696	72%	7%	7	10	79%	25%	11%
2016/17	1792	72%	9%	5	8	82%	27%	12%

## Benchmarking

The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected subgroup of patients. This subgroup is referred to as the Utstein Comparator Group and requires that the following criteria be met: All-cause, resuscitation attempted, shockable presenting rhythm, bystander witnessed. Excludes EAS personnel witnessed events.

**Table 2: Benchmarking survival outcomes for adults. Utstein Comparator Group.**

Ambulance Service	Collection period	Total number events	% ROSC on handover	% Survival
St John New Zealand	1 July 2016 to 30 June 2017	512	50%	30% <sup>B</sup>
Wellington Free Ambulance <sup>A</sup>	1 July 2016 to 30 June 2017	67	58%	30%
Ambulance Victoria <sup>9</sup>	1 July 2015 to 30 June 2016	482	57%	35%
<sup>C</sup> London Ambulance Service <sup>7</sup>	1 April 2016 to 31 March 2017	606	55%	30%
<sup>D</sup> St John Ambulance Western Australia <sup>11</sup>	1 July 2016 to 30 June 2017	94	31%	27%
King County EMS <sup>10</sup>	1 January 2016 to 31 December 2016	166	80%	52%



- A** Unless otherwise stated all analyses in this report are for adults ≥16yrs and all analyses are exclusive of cardiac arrests witnessed by St John EAS personnel.
- B** St John New Zealand reports on survival to 30-days, all other services report survival to hospital discharge.
- C** London Ambulance Service includes only those with a presumed cardiac cause.
- D** Note: Perth metropolitan area.

# The St John Out-of-Hospital Cardiac Arrest Registry

**The St John OHCA Registry was formally established in September 2013. Since the registry was established, data for cardiac arrests attended by St John has been successfully captured for more than 17,000 patients.**

The St John OHCA Registry is overseen by Dr Bridget Dicker, St John Head of Clinical Audit and Research and Auckland University of Technology Senior Lecturer.

## Eligibility

St John captures data on all OHCA events attended by the St John EAS. St John defines a cardiac arrest as a patient who is unconscious and pulseless with either agonal breathing or no breathing.

Inclusion and exclusion criteria are described in Table 3 and Table 4.

## Data capture

This report reflects data recorded between 1 July 2016 and 30 June 2017. The data is collated in the registry using a reporting template based on international definitions outlined in the Utstein style of reporting and the variables developed by the Australian Resuscitation Outcomes Consortium (Aus-ROC)<sup>5,6</sup>.

In the data collection process there are three separate points where data is acquired:

- Computer Aided Dispatch (CAD) and supporting systems
- On scene by the EAS personnel in attendance
- Mortality data from the New Zealand National Health Index (NHI) records.

## Computer aided dispatch

Patient and event details are collected by the Clinical Control Centre when a 111 call is received and an ambulance is dispatched, with data being entered into the computer aided dispatch (CAD) system. Data specifically related to cardiac arrest is obtained from the CAD system and transferred into the St John OHCA Registry.

**Table 3: Inclusion criteria (all of the following).**

<b>1</b>	Patients of all ages who suffer a documented cardiac arrest
<b>2</b>	Occurs in New Zealand where St John or one of its participating co-responders is the primary treatment provider
<b>3</b>	<ul style="list-style-type: none"> <li>➤ Patients of all ages who on arrival of the St John EAS are unconscious and pulseless with either agonal breathing or no breathing <b>or</b></li> <li>➤ Patients of all ages who become unconscious and pulseless with either agonal breathing or no breathing in the presence of St John EAS personnel <b>or</b></li> <li>➤ Patients who have a pulse on arrival of St John EAS personnel following successful bystander defibrillation.</li> </ul>

**Table 4: Exclusion criteria (any of the following).**

<b>1</b>	Patients who suffer a cardiac arrest in a hospital facility where St John EAS may be in attendance but are not the primary treatment providers
<b>2</b>	Patients who suffer a cardiac arrest during an inter-hospital transfer where St John EAS may be providing transport but are not the primary treatment providers
<b>3</b>	Bystander suspected cardiac arrest where the patient is not in cardiac arrest on arrival of the St John EAS personnel, and where defibrillation did not occur prior to ambulance arrival or no other evidence verifying a cardiac arrest state is present
<b>4</b>	Patients who suffer a cardiac arrest where Wellington Free Ambulance is the primary treatment provider

## On scene collection

Ambulance officers on scene attending a patient in cardiac arrest are required to record specific data. This is recorded on an electronic Patient Report Form (ePRF) and submitted electronically to a secure server.

## NHI patient outcome data

The patient's NHI is collected by EAS personnel on scene or at hospital handover. If the NHI was not available at the time of the event then the NHI is determined by cross-reference of the patient's date of birth and name to the NHI database.

The date of death is updated by the Ministry of Health identity data management team after matching NHI identity with the official death registrations on a monthly basis.

## Data quality

The registry is subject to quality improvement processes which involve continual auditing of existing data and updating of the registry entries as appropriate.



Registry reports are generated on a monthly and quarterly basis and these are analysed for variances in the numbers of cases and patient outcomes. These results are compared with international data from EAS that are similar to St John. In this report, comparison is made between Wellington Free Ambulance, Ambulance Victoria, London Ambulance Service, St John Ambulance Western Australia and King County EMS where applicable<sup>7-11</sup>.

### Missing data

Since the registry's inception there have been improvements made to the proportion of missing data. The overall fraction of missing pre-hospital data is now relatively low, which is reflective of an EAS culture that values continuous monitoring to improve patient outcomes.

Within the ePRF platform, the cardiac arrest data form and the ethnicity fields are compulsory. The ethnicity capture from the ePRF data is greater than 97%.

### Ethical review

The St John OHCA Registry has been approved by the New Zealand Health and Disability Ethics Committee (Ethics reference 13/STH/192) and the Auckland University of Technology Ethics Committee (Ethics reference 13/367).

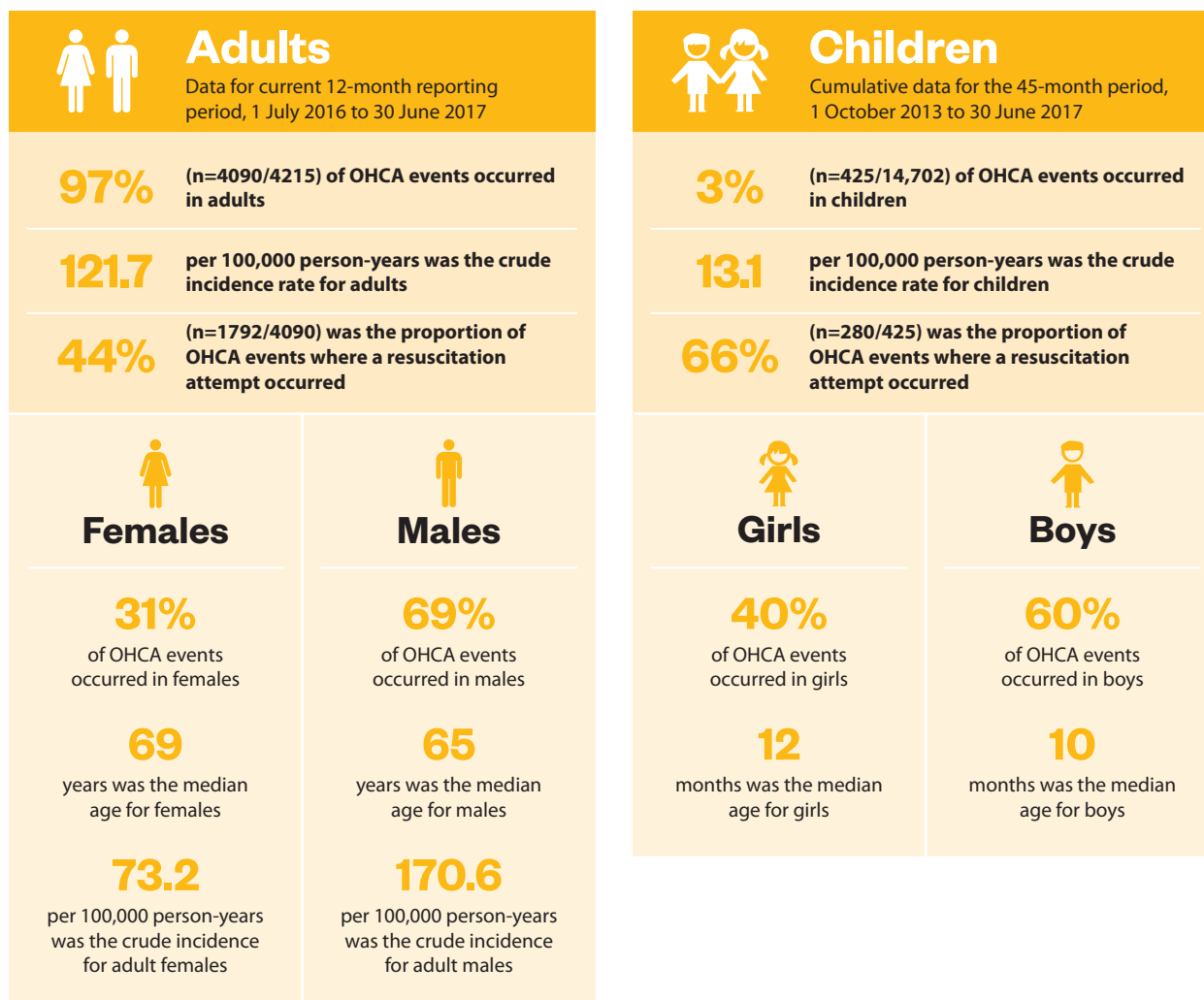
The registry is also subject to St John internal research governance processes that include a locality review and locality authorisation as per the Standard Operating Procedures for Health and Disability Ethics Committees.

The St John OHCA Registry is held on a secure server which requires active directory permissions. At no stage is data that could identify individual patients or individual hospitals released from this registry. ■



# Incidence and demographics

## Key figures for adults (≥ 16yrs) and children<sup>E</sup>



The crude incidence rate for adults was comparable to other services, with Ambulance Victoria reporting a rate of 86.7 per 100,000 person-years<sup>9</sup>. The crude incidence rates for males were around twice that of females. In contrast to crude data (Figure 1), when standardised to individual age groups, males in all age groups had a higher incidence of OHCA per 100,000 person-years compared with females (Figure 2).

The incidence rate for children was higher than comparable services, with Ambulance Victoria reporting a rate of 7.4 per 100,000 person-years during the 2014 – 2015 reporting period. This finding

is in-line with 2013 OECD mortality data which reports 1.4 times higher infant mortality in New Zealand compared with Australia<sup>16</sup>. There was also a higher proportion of cardiac arrest in boys (60%) compared to girls (40%). The higher incidence of cardiac arrest in boys aligns with the tenth New Zealand Child and Youth Mortality Review Report (2014), which showed a higher mortality rate for male children compared to female children (65.3% versus 34.7%)<sup>17</sup>. Over the 45-month period, resuscitation was attempted in a proportionally higher percentage of events for children than for adults.

<sup>E</sup> Excludes EAS witnessed events.

### Age distribution of OHCA by sex

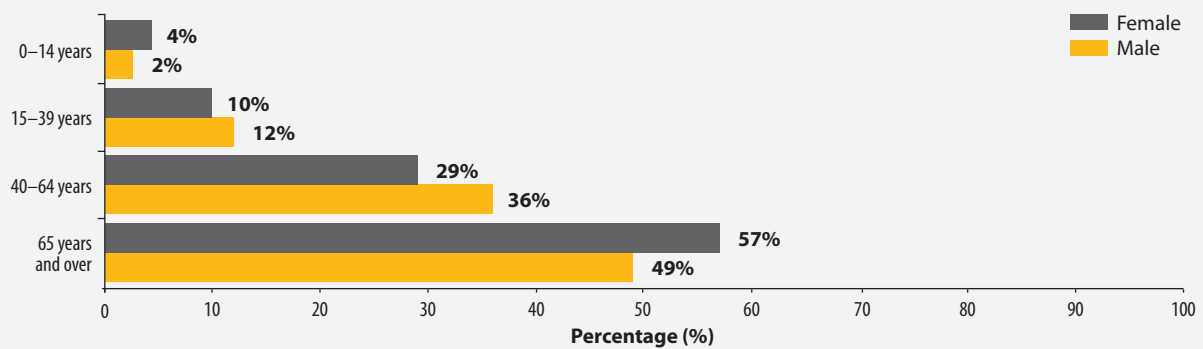


Figure 1: Age distribution of OHCA (all events).

### Age distribution of OHCA – standardised per 100,000 person years

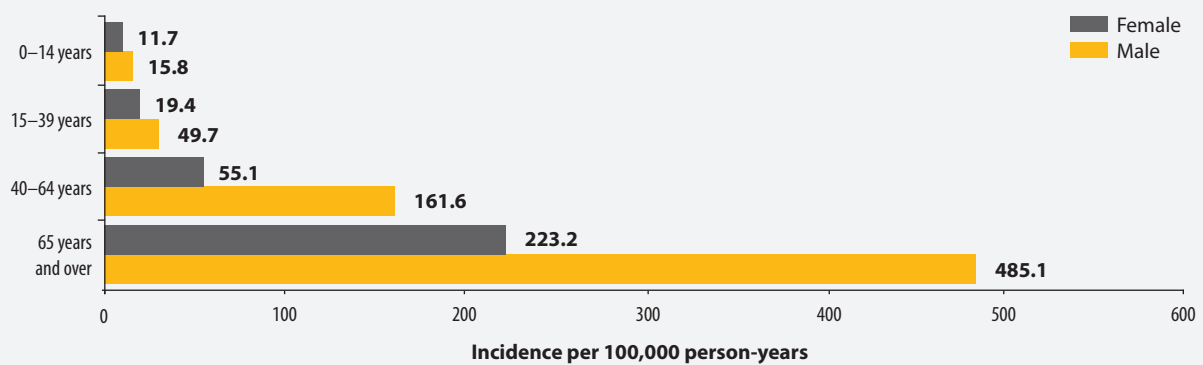


Figure 2: Age, standardised incidence of OHCA per 100,000 person-years (all events).





Ethnicity

The majority of OHCA events attended by St John EAS were for patients of European and other ethnicity,<sup>F</sup> as defined by the Statistics New Zealand population groups<sup>G,13</sup> (Figure 3).

When standardised to the New Zealand ethnic population groups, as a fraction of the parent population, Māori had a disproportionally higher incidence of OHCA per 100,000 person-years (106.6) compared with non-Māori (less than 90) (Figure 4)<sup>13</sup>. This aligns with New Zealand Ministry of Health figures which indicate that Māori are disproportionately affected by ischaemic heart disease. Māori adults are 1.8 times more likely to be diagnosed with ischaemic heart disease than non-Māori adults<sup>18</sup>.

Māori had a crude incidence rate 1.2 times that of the European and other ethnic group.

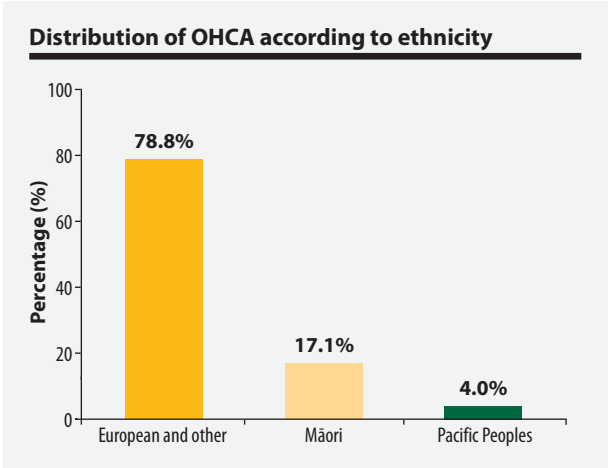
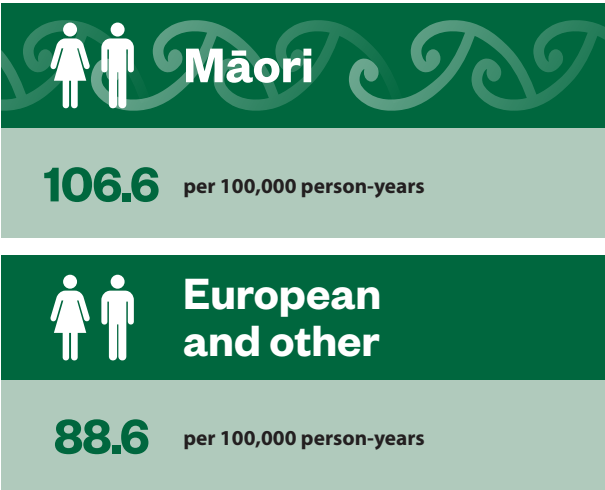


Figure 3: Distribution of OHCA according to ethnicity (all events).

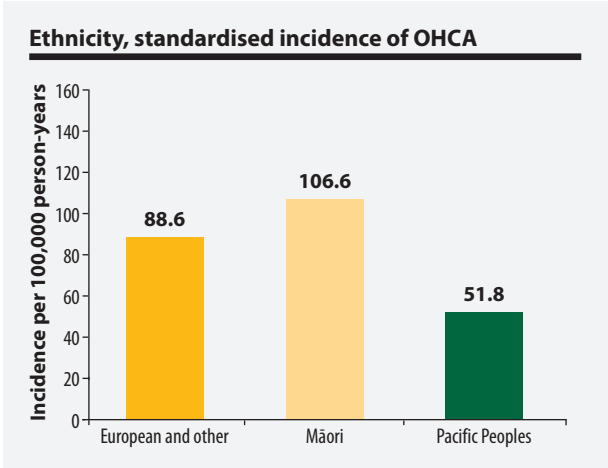


Figure 4: Ethnicity, standardised incidence of OHCA per 100,000 person-years (all events).

**F** European and other includes, New Zealander, Asian, Middle Eastern, Latin American and African  
**G** Crude incidence rates are based on 2013 Statistics New Zealand data with an estimated annual growth of 2%

## Incidence across urban and rural/remote areas

The population within the St John jurisdiction is classified as urban or rural and remote as per the Glossary of terms (p31) at the end of this report. A larger proportion of the New Zealand population is based within metropolitan centres and consequently a greater portion of OHCA events attended by St John occurred within metropolitan localities (68%). The incidence rate for the urban population was 71.7 per 100,000 person-years and the rural/remote population was 99.6 per 100,000 person-years.

## Incidence across regions of New Zealand

The response areas covered by St John are divided into three regions, Northern, Central and South Island Region. Northern Region (n=1,657) covers the area from Hauraki to the Far North, Central Region (n=1,479) covers from Horowhenua to the Waikato and South Island Region (n=1,027) covers the entire South Island.

The incidence of OHCA per 100,000 person-years was calculated based on population estimates from Statistics New Zealand (Figure 5)<sup>15</sup>.

**The three St John regions, standardised incidence of OHCA**

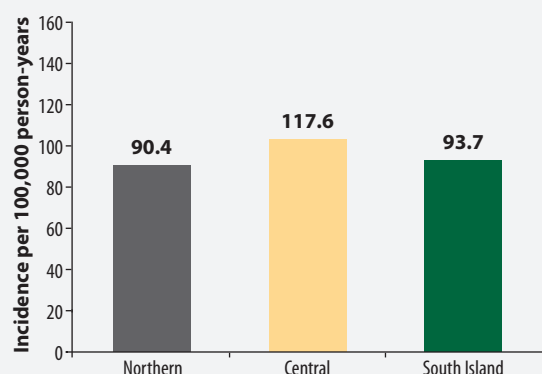


Figure 5: The three St John regions, incidence of OHCA per 100,000 person-years (all events).







### Heat map of OHCA events in the three St John regions

Red represents the highest concentration of OHCA on the heat map of OHCA events in the three St John Regions, followed by yellow and then green (Figure 6). The heat map in Figure 6 represents where the majority of events occur and is focused on areas of population density<sup>H</sup>.

### Precipitating events for adults

St John EAS personnel presume an OHCA to be of cardiac cause unless it is known or likely to have been caused by trauma, drowning, poisoning or any other non-cardiac cause. The most common aetiology of OHCA in adults where resuscitation was attempted was that of a presumed cardiac cause, which constituted 81% of events. Other common precipitating causes included respiratory arrest (6%), trauma (3%) and hanging (3%) (Figure 7).

### Precipitating causes for children

The occurrence of OHCA in children is rare therefore cumulative data for a 45-month period from 1 October 2013 to 30 June 2017 was used for the analysis of precipitating causes. During the 45-month period there were a total of 280 events in children where resuscitation was attempted. Of these, the leading cause of OHCA in children was sudden unexpected death in infancy (SUDI) at 31%, followed by respiratory arrest at 25% (Figure 8). These findings are consistent with those of the New Zealand Mortality Review Data Group, which show that the incidence of SUDI in New Zealand is one of the highest among industrialised countries and the leading cause of death in children aged less than one year<sup>17</sup>.

### OHCA location

The most common place for an OHCA to occur is in a person's home, with 69% of events where resuscitation was attempted occurring at home. The second most common place for an OHCA to occur is in a public area (22%), which includes the workplace, the street, a shopping centre or similar (Figure 9). ■

<sup>H</sup> Heat map is not standardised to incidence per 100,000 person-years



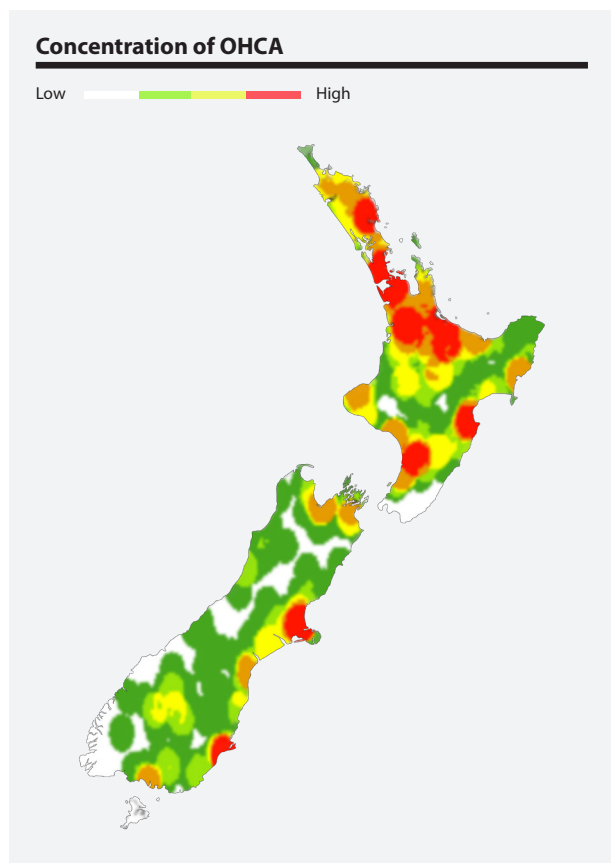


Figure 6: Concentration of OHCA events across the three St John regions.

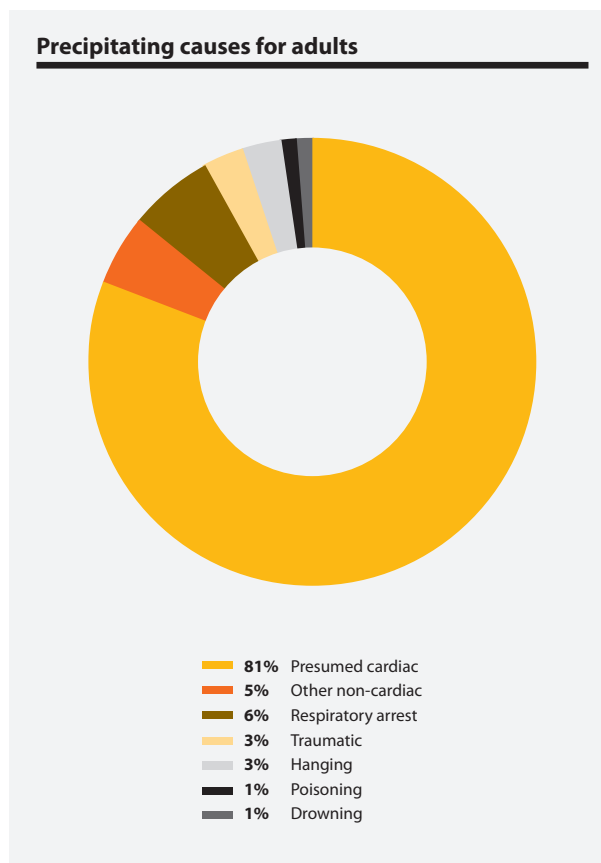


Figure 7: Precipitating causes for adults (resuscitation attempted).

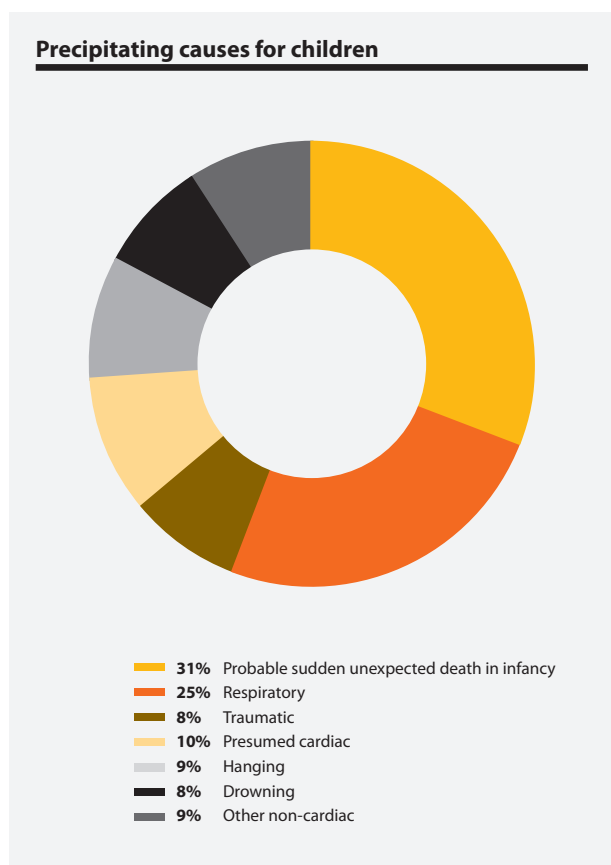


Figure 8: Precipitating causes for children (45-months, resuscitation attempted).

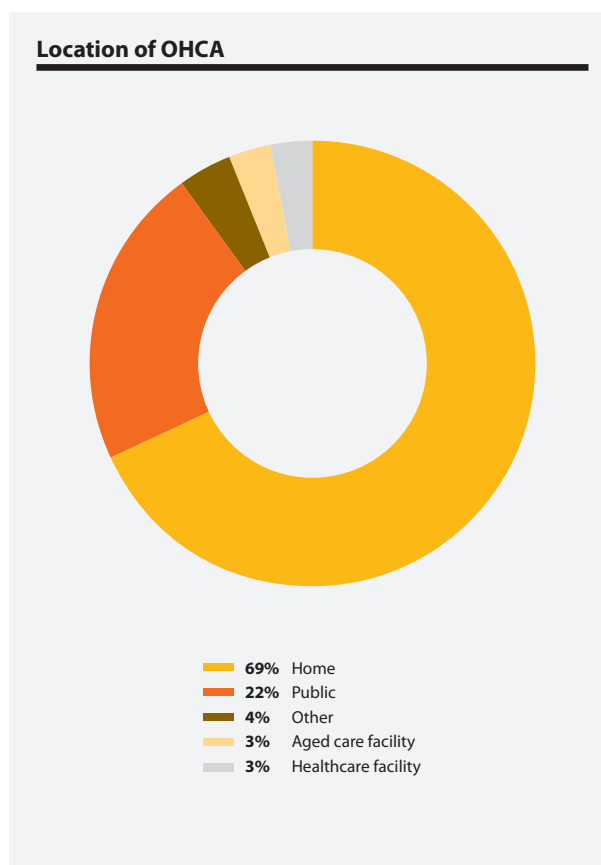


Figure 9: Location of OHCA for adults (resuscitation attempted).

# The Global Resuscitation Alliance

## 10 Steps to improving OHCA outcomes

- |   |           |  |
|---|-----------|--|
|    | <b>1</b>  | <b>Establish a cardiac arrest registry</b>   |
|    | <b>2</b>  | <b>Provide telephone-CPR instructions with ongoing training and quality improvement</b>                                  |
|    | <b>3</b>  | <b>Provide high-performance CPR with ongoing training and quality improvement</b>  |
|    | <b>4</b>  | <b>Use rapid dispatch</b>  |
|   | <b>5</b>  | <b>Measure resuscitation performance using the defibrillator recording</b>   |
|  | <b>6</b>  | <b>Begin an AED programme for first responders, including police officers, guards, and other security personnel</b>      |
|  | <b>7</b>  | <b>Use smart technologies to notify volunteer bystanders so they can respond to provide early CPR and defibrillation</b> |
|  | <b>8</b>  | <b>Make CPR and AED training mandatory in schools and communities</b>  |
|  | <b>9</b>  | <b>Be accountable – publicise annual reports</b>   |
|  | <b>10</b> | <b>Provide a culture of excellence</b>   |

The concept of the Resuscitation Alliance is that all members of the Global Resuscitation Alliance, of which St John NZ is one, will use and promote the 10 Steps for Improving Survival from Sudden Cardiac Arrest thus extending the best practices in cardiac arrest survival internationally.

Each of the 10 Steps consists of a number of elements outlined within the infographic and in detail within the foundation paper that can be downloaded here: <https://foundation915.files.wordpress.com/2016/07/a-call-to-establish-a-global-resuscitation-alliance-2016.pdf><sup>19</sup>



1

## Establish a cardiac arrest registry

The St John OHCA Registry was established in October 2013 and now contains over 17,000 records of OHCA. This continuous measuring and reporting

sets the stage for implementing change and making improvements over time.



2

## Provide telephone-CPR instructions with ongoing training and quality improvement

The Clinical Control Centre personnel play a pivotal role in the rates of early bystander CPR. As soon as emergency Call Handlers suspect a patient is in cardiac arrest they provide instructions to the caller over the phone on how to perform CPR. This Call Handler directed CPR has been in place since 2002.

Call Handlers are also adept in directing callers to the location of AEDs. When AEDs are logged with AED-locations (<https://aedlocations.co.nz>) Call Handlers may access the AED-locations website and guide callers to the location of an AED. Alternatively, when AED details are provided directly to St John they are entered into our dispatch system so that when someone calls 111, Call Handlers can automatically visualise the AEDs within a 200m radius of the person calling. Also, if the caller states the patient is located at a different address, the Call Handler will be able to search the system and guide the caller to the AED.

### Rates of bystander CPR

Of the OHCA where resuscitation was attempted, 72% of these had bystander CPR performed prior to ambulance arrival (witnessed and unwitnessed combined). This figure is similar to previous results (Figure 10).

**Bystander CPR rates**

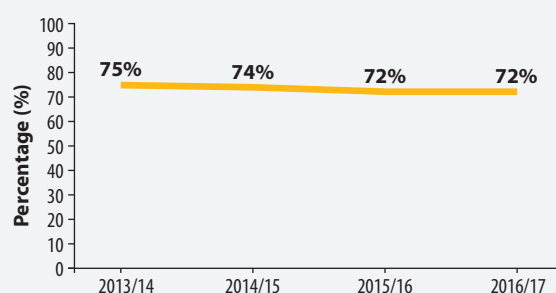


Figure 10: Bystander CPR rates for all-cause OHCA in adults (resuscitation attempted).



3

## Provide high-performance CPR with ongoing training and quality improvement

The St John Clinical Development team provide St John and co-responder personnel with CPR training through a programme of Continuing Clinical Education (CCE). During this reporting period specialised manikins were introduced to this programme that measured chest compression performance. Staff were expected to achieve a score

of 80%. Over the next 18 months, we intend to move towards annual resuscitation re-certification with a focus on high-performance CPR. We are also planning to improve access to manikins which measure CPR quality and provide feedback so that personnel can achieve a minimum score of 90% every six months.





Use rapid dispatch

With time to defibrillation crucial, St John has protocols to ensure that patients in cardiac arrest are reached in the shortest possible time by responders trained in CPR and with access to a defibrillator. Clinical Control Centre staff give a cardiac arrest the highest priority and dispatch the closest resource immediately.

The time between when an emergency call is answered in the Clinical Control Centre to when an ambulance arrives is crucial. This is one of the key performance indicators for St John EAS and the target

is to get trained personnel with a defibrillator to the patient as quickly as possible.

For OHCA where resuscitation was attempted by St John EAS, the median response time (from call pick up in the Clinical Control Centre to arrival of the ambulance on scene) was five minutes in urban areas and eight minutes for rural and remote areas (Figure 11 and Figure 12).

Additionally, we currently have a dispatch focused audit initiative to ensure the closest resource with a defibrillator is always alerted to a cardiac arrest.

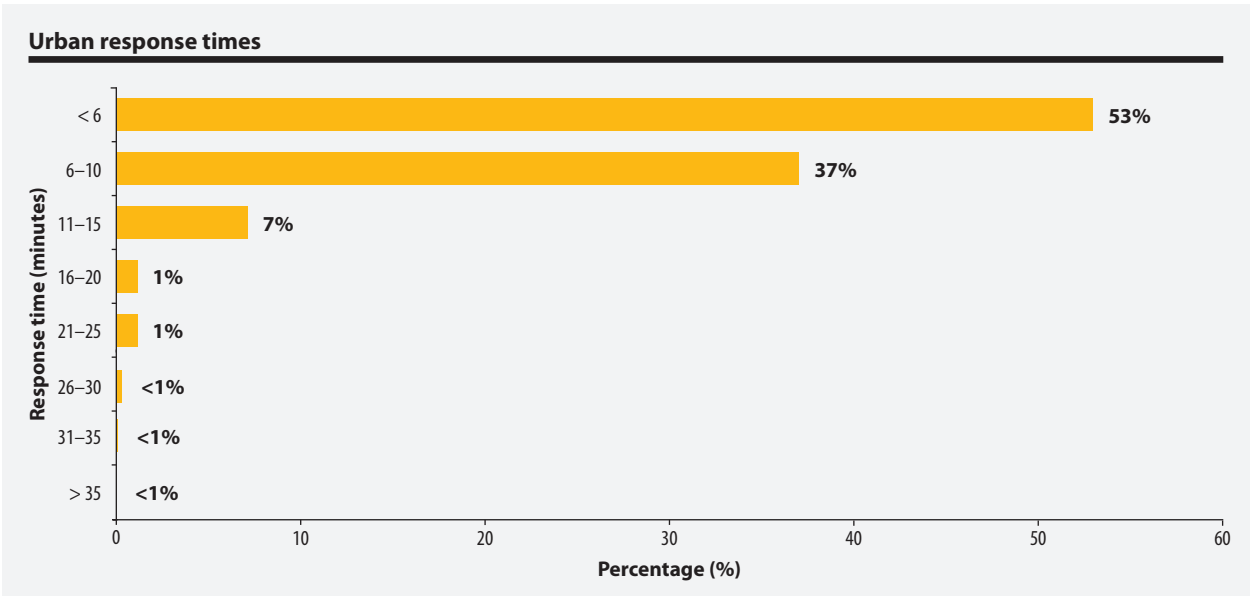


Figure 11: Urban response, time from answering the call to arrival of ambulance (adults, resuscitation attempted).

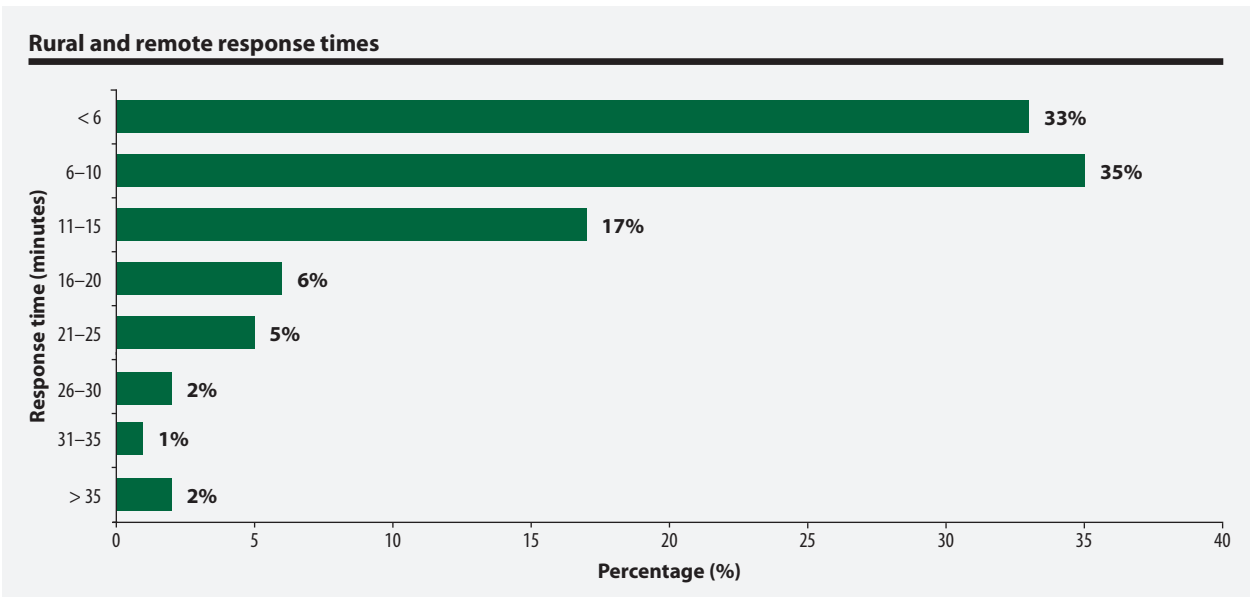


Figure 12: Rural and remote response, time from answering the call to arrival of ambulance (adults, resuscitation attempted).



5

## Measure resuscitation performance using the defibrillator recording

There is a range of defibrillators on the market now and many of these enable us to record information regarding the quality of CPR being performed at

the scene. In future we plan to explore being able to download this information and provide constructive feedback on CPR quality to responding personnel.



6

## Begin an AED programme for first responders, including police officers, guards, and other security personnel

When there is a suspected cardiac arrest the Clinical Control Centre immediately dispatches the closest resource, regardless of qualification, which may be an emergency ambulance or any other co-responder including the St John Patient Transfer Service, Fire and Emergency New Zealand, local first response groups or Primary Response in Medical Emergencies (PRIME) doctors and nurses. By dispatching the nearest resource, defibrillation and CPR can occur as quickly as possible, which may be before EAS arrival.

### Fire and Emergency New Zealand

Since December 2013 Fire and Emergency New Zealand has been part of the team of professionals available to co-respond to an OHCA.

During this reporting period (1 July 2016 to 30 June 2017), Fire and Emergency New Zealand attended more than 80% (n=1,461) of adult OHCA events where resuscitation was attempted by EAS.

Early CPR is one of the key links in the chain of survival and, in 13% of adult OHCA events where resuscitation was attempted by EAS, Fire and Emergency New Zealand arrived on scene first to provide early CPR and use an AED.

During this reporting period Fire and Emergency New Zealand was fundamental in the early defibrillation of 102 adult patients in cardiac arrest. Of these patients 18% survived.



7

## Use smart technologies to notify volunteer bystanders so they can respond to provide early CPR and defibrillation

Around 20% of cardiac arrests occur in a public area, therefore public access defibrillators and community first aid training have a large role to play in early defibrillation. If an emergency Call Handler suspects they are dealing with a cardiac arrest, one of the first questions they ask is if an AED is available. If so, they provide instructions on how to use it, as well as on how to perform CPR.

When a public access defibrillator is used by bystanders before the arrival of emergency services, patient outcomes dramatically improve with 44% of these patients surviving. In comparison 10% of

patients survived if a defibrillator was not used prior to EAS arrival. However, the total number of patients defibrillated using public access defibrillators was low constituting only 9% (n=36) of events that occurred in public (n=396).

St John is currently in the process of implementing the GoodSAM (Good Smartphone Activated Medics) which will alert community responders to nearby cardiac arrests so that they can provide early CPR and use an AED.



## Make CPR and AED training mandatory in schools and communities

To improve the rates of bystander CPR and AED use, St John supports several community initiatives. These include the 3 Steps for Life community awareness programme, the ASB St John in Schools programme, and the National Marae OHCA project.

### 3 Steps for Life

[www.stjohn.org.nz/3stepsforlife](http://www.stjohn.org.nz/3stepsforlife)

3 Steps for Life is designed to give all New Zealanders the confidence and awareness to take action when somebody suffers a cardiac arrest by

- Calling 111
- Starting CPR
- Using an AED

This initiative is an opportunity for our people to deliver free community awareness sessions with the potential to save up to 500 lives a year. All St John personnel with an Authority to Practise at Emergency Medical Technician level (or above), along with certified St John tutors, can volunteer to run a one-hour CPR and AED 3 Steps for Life awareness session for community groups such as sports clubs, retirement villages and marae communities.

### ASB St John in Schools

[www.stjohn.org.nz/asbstjohninschools](http://www.stjohn.org.nz/asbstjohninschools)

St John recognises that children also have a role to play in a community response to an OHCA. Between

1 July 2016 and 30 June 2017, the ASB St John in Schools programme trained about 37,340 children in CPR and there are more than 7,300 St John Youth members engaged in learning first aid and CPR.

### National Marae OHCA project

Māori are more at risk of cardiac arrest than non-Māori. St John is working with marae around New Zealand to engage with Māori and support them with access to AEDs and training in CPR. During the period of this report, St John has engaged with more than 60 marae and has delivered the 3 Steps for Life sessions to nearly 100 people since the programme was launched in June 2016.

### Online resources

St John has developed several online videos and a smartphone application which are freely available to the public to help them learn CPR and how to use an AED.

- The St John CPR App [www.stjohn.org.nz/cprapp](http://www.stjohn.org.nz/cprapp)
- Learn how to do CPR and to use an AED, 3 Steps for Life [www.stjohn.org.nz/3stepsforlife](http://www.stjohn.org.nz/3stepsforlife)

### Engagement with the Ministry of Education

St John supports the New Zealand Resuscitation Council engaging with the Ministry of Education to discuss the possibility of first aid training, including CPR and how to use an AED, being added to the compulsory education curriculum.







9

## Be accountable – publicise annual reports

All of the OHCA Registry annual reports are publicly available. The current report and all previous reports can be downloaded from the St John website here: <http://www.stjohn.org.nz/News--Info/Our-Performance/Cardiac-Arrest-Annual-Report/>



10

## Provide a culture of excellence

To achieve change and a culture of excellence, St John relies on evidence gathered through research and audit. The St John Clinical Audit and Research Team frequently publishes in peer reviewed journals, presents at leadership meetings, analyses data in conjunction with Medical Directors and uses data to inform training.

In the 2016/17 reporting period, publication of *“The association between the first locating emergency ambulance being single crewed and cardiac arrest outcomes”* in the New Zealand Medical Journal provided evidence to support our plan to eliminate the use of single crewed emergency transporting ambulances<sup>20</sup>.

# Outcomes

## Adult outcome from all-cause cardiac arrest

The results from the St John OHCA Registry show an event survival rate (ROSC sustained to hospital handover) of 27%. This is similar to previous reporting periods as shown in Figure 13.

The rate of survival in adults where resuscitation was attempted was 12%. This rate remains similar to previous years (Figure 13).

## Utstein Comparator Group

The outcomes of OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected subgroup of patients. This subgroup is referred to as the Utstein Comparator Group and requires the following criteria to be met: All-cause, resuscitation attempted, shockable presenting rhythm, bystander witnessed and excluding EAS personnel witnessed events.

There were 512 cardiac arrests attended by St John that met these criteria which constituted around 30% of all events where resuscitation was attempted.

For this selected subgroup the rate of survival was 30% (Figure 14). This result is benchmarked against other services within the executive summary page (Table 2).

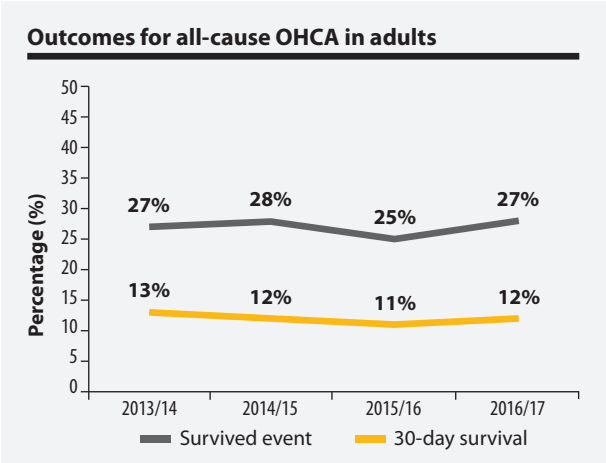


Figure 13: Outcomes for all-cause OHCA in adults (resuscitation attempted).

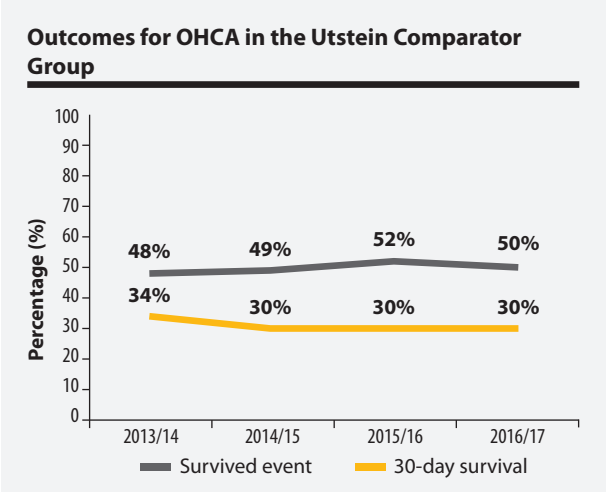


Figure 14: Outcomes of OHCA in the Utstein Comparator Group (resuscitation attempted).







### Scene outcome for OHCA in adults

One of the contributing factors to patient survival is good quality chest compressions during CPR. Performing CPR during the transport of a patient following an OHCA may compromise the quality of the CPR being delivered<sup>21</sup>. Therefore, in the majority of OHCA events, it is appropriate to continue resuscitation at the scene until either return of spontaneous circulation (ROSC) occurs or resuscitation is ceased. This is reflected in the scene outcomes observed in adult patients where resuscitation was attempted (Figure 15). The overall percentage of patients transported with CPR in place was 2%, transported with ROSC was 28% and died at the scene was 70%.

### Adult outcomes according to presenting rhythm

Patients who present with a shockable rhythm such as ventricular fibrillation (VF) or ventricular tachycardia (VT), have a greater chance of survival than patients who present with a non-shockable rhythm such as pulseless electrical activity (PEA) or asystole.

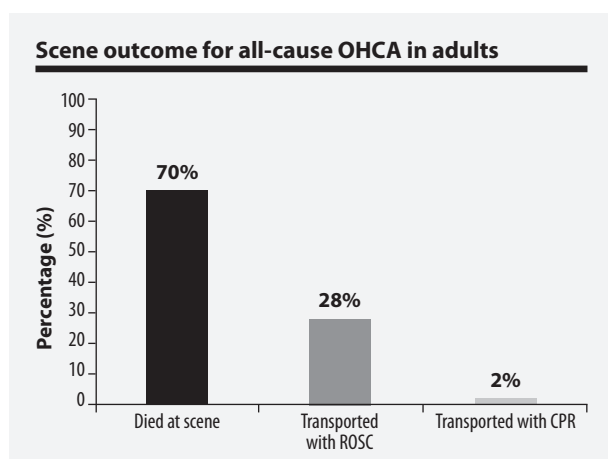


Figure 15: Scene outcome for all-cause OHCA in adults (resuscitation attempted).

Adult patients who had resuscitation attempted and presented with a shockable rhythm, had an event survival rate of 46%. This compares with 32% for those in PEA and 7% for those in asystole. Similarly, adult patients presenting with a shockable rhythm had a higher rate of survival of 27%. This compares with 6% for those in PEA and less than 1% for those in asystole (Figure 16).

### EAS personnel witnessed outcomes

If a patient presents with a shockable rhythm and the arrest is witnessed by EAS personnel, the immediate intervention of defibrillation can lead to the best outcomes. Of the adult patients who had a shockable presenting rhythm where the arrest was witnessed by EAS personnel (n=147), the rate of event survival was 78% and survival to 30-days was 63%.

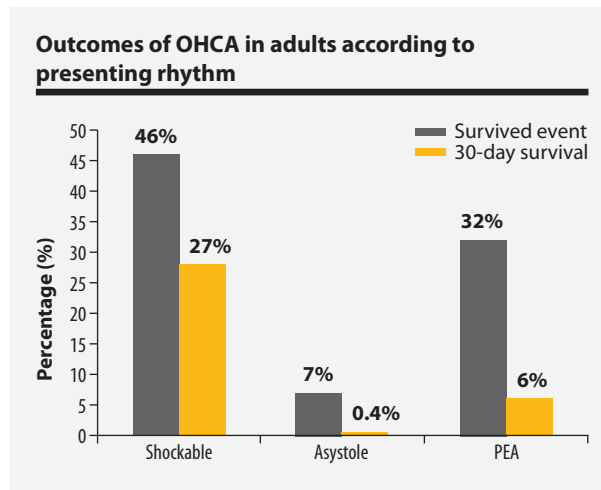


Figure 16: Outcomes for OHCA in adults according to presenting rhythm (resuscitation attempted).



**Adult outcomes according to rurality**

As only a small number of cardiac arrests occur annually in rural areas, outcomes were measured across a 45-month period from 1 October 2013 to 30 June 2017. Patients who had a cardiac arrest in a rural or remote location had a lower percentage of survival when compared to patients who had a cardiac arrest in an urban location (Figure 17).

**Adult outcomes according to region**

As only a small number of cardiac arrests occur annually in each region, outcomes at a regional level were measured across a 45-month period from 1 October 2013 to 30 June 2017. Further work is required to understand any differences in outcomes between regions (Figure 18).

**Adult outcomes according to location**

Survival rates between private residence and public area locations were compared.

Cardiac arrests where resuscitation was attempted by EAS were more likely to have been witnessed when the OHCA occurred in a public area (72%) as opposed to those that occurred at a private residence (55%). Events where resuscitation was attempted were also more likely to have bystander CPR performed when the OHCA occurred in a public area (84%) as opposed to those that occurred at a private residence (68%).

Survival from OHCA is substantially influenced by whether a cardiac arrest is witnessed and bystander CPR is performed<sup>20</sup>. This is reflected in the higher rates of survival observed in the group of patients who suffered a cardiac arrest in a public area (24%) compared to those who were at a private residence at the time (8%) (Figure 19).

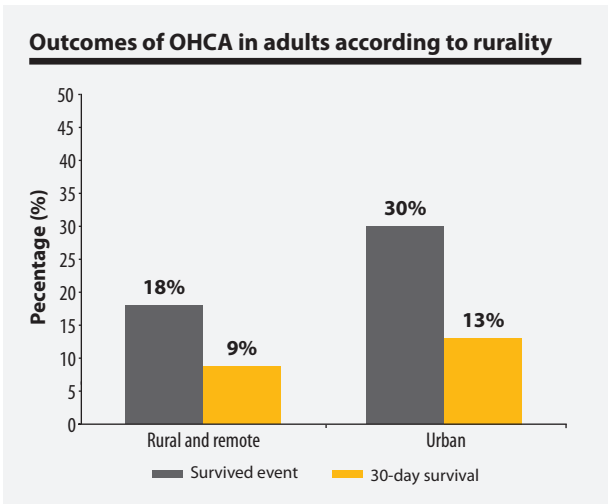


Figure 17: Rural/remote versus urban areas, influence of location on outcome (adults, 45-months, resuscitation attempted).

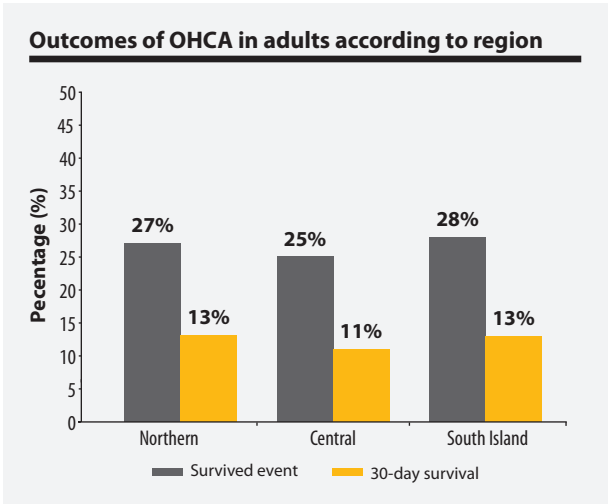


Figure 18: The three St John regions, influence of region on outcome (adults, 45-months, resuscitation attempted).

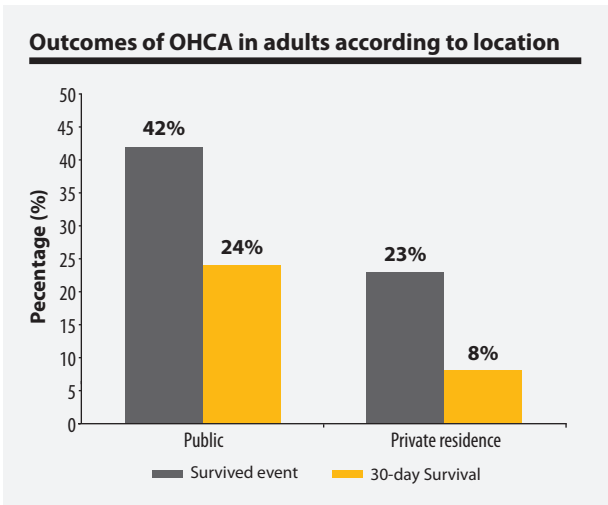


Figure 19: Private residence and public, influence of location on outcome (adults, 45-months, resuscitation attempted).

## Outcomes from all-cause OHCA occurring in children

OHCA occurring in children is rare with a total of 106 events attended by St John EAS for this reporting period. Due to the low incidence of cardiac arrest within the 12-month period, outcomes were analysed on cumulative data for a 45-month period (n=425, 1 October 2013 to 30 June 2017).

The precipitating causes of OHCA in children and the factors affecting survival differ markedly from adults. In children the presenting rhythm is seldom shockable. Only 6% (n=17) of children who had resuscitation attempted by EAS personnel (n=280) presented with a shockable rhythm. The most common precipitating event for OHCA in children is sudden unexpected death in infancy SUDI (n=86) from which there was one survivor. Overall event survival for children where resuscitation was attempted by EAS personnel was 17% (n=48) and survival to 30-days was 8% (n=21). However, due to the low total number of events in children these rates must be interpreted with caution because there is insufficient data to have confidence in the results.

## Conclusion

The data presented in this report indicates that the service provided by St John in treating OHCA continues to be of a high quality and compares favourably with other similar emergency ambulance services internationally.

The data in this report will drive discussion on clinical improvements as part of ongoing service planning and continual improvement within St John. As a result, new processes, technologies and research strategies may be implemented and the impact of these strategies will be measured. Measuring changes in outcomes year-on-year enables St John to improve the treatment of OHCA, ultimately leading to better patient survival rates. ■



## Abbreviations

<b>AED</b>	Automated external defibrillator	<b>MPDS</b>	Medical priority dispatch system
<b>CAD</b>	Computer aided dispatch	<b>OHCA</b>	Out-of-hospital cardiac arrest
<b>CPR</b>	Cardiopulmonary resuscitation	<b>PEA</b>	Pulseless electrical activity
<b>DHB</b>	District Health Board	<b>PRIME</b>	Primary response in medical emergencies
<b>EAS</b>	Emergency ambulance service	<b>ROSC</b>	Return of spontaneous circulation
<b>ECG</b>	Electrocardiogram	<b>SUDI</b>	Sudden unexpected death in infancy
<b>EMS</b>	Emergency medical services	<b>VF</b>	Ventricular fibrillation
<b>EMT</b>	Emergency medical technician	<b>VT</b>	Ventricular tachycardia
<b>ICP</b>	Intensive care paramedic		

## Glossary of terms

<b>Adult</b>	Patients aged 16 years or older.
<b>Asystole</b>	The absence of any cardiac electrical activity.
<b>Children</b>	Patients aged less than 16 years.
<b>EAS attended</b>	This is the population of all patients following cardiac arrest where St John EAS personnel attended regardless of whether emergency treatment was provided.
<b>EAS personnel</b>	Where St John EAS personnel respond to a medical emergency in an operational capacity as part of an organised medical response team.
<b>Presumed cardiac aetiology</b>	An OHCA is presumed to be of cardiac aetiology, unless it is known or likely to have been caused by trauma, drowning, poisoning or any other non-cardiac cause.
<b>Return of spontaneous circulation</b>	The patient shows clear signs of life in the absence of chest compressions for more than 30 seconds. Signs of life include any of the following: Normal breathing, palpable pulse, normal end tidal CO <sub>2</sub> or normal movement.
<b>Resuscitation attempted</b>	The performance of CPR by or under the direction of responding EAS personnel, or the delivery of a shock at any time (including before ambulance arrival).
<b>Shockable rhythm</b>	Ventricular fibrillation, ventricular tachycardia or unknown shockable (AED).
<b>Survived event</b>	The patient has sustained ROSC to handover at hospital.
<b>Survival to 30-days</b>	The patient is alive at 30 days post-OHCA event.
<b>Witnessed event</b>	A witnessed cardiac arrest is one that is seen or heard by another person.



<b>Urban service area</b>	Main urban centres with a population greater than 15,000. This includes responses that occur within a city boundary as per specified cluster of mesh blocks on the NZ Geographical Information Systems (GIS) service area map. For the purposes of this analysis this is inclusive of areas denoted by Statistics NZ as main urban area or satellite urban area <sup>12</sup> .
<b>Rural and remote service area</b>	Rural and remote areas with a population of less than 15,000. This includes responses occurring in areas surrounding urban cities, minor urban/provincial centres and very rural and remote locations as per specified cluster of mesh blocks on the NZ GIS service area map. For the purposes of this analysis this is inclusive of areas denoted by Statistics NZ as any of the following: independent urban area, rural area with high urban influence, rural area with moderate urban influence, rural area with low urban influence or highly rural/remote area <sup>12</sup> .

## The St John New Zealand OHCA Registry Group

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